Growth of Fish Embryo in Microgravity
A UB-Student Spaceflight Experimental Project Mission 12

Phuong Nguyen [1], Eric Bialczak [2], Jhoel Luciano [1], Abdoul Aremu[1]

Mentor: Professor Jani Macari Pallis[1] , Trinadh Venna[3]

[1]Department of Mechanical Engineering
[2]Department of Computer Engineering
[3]University of Bridgeport, Bridgeport, CT

RESEARCH QUESTIONS

The reason that this experiment will be conducted is to see the growth of a fish embryo in microgravity. Our basic question is "How will microgravity affect the early growth of an organism?". The reason that it will be conducted in microgravity is because if we ever colonize space we will need to know the effects of low gravity on a developing human embryo. This is vital because colonization of low gravity areas will require new people to be born and if microgravity leads to birth defects then we need to know before hand. Birth defects from microgravity are a real possibility. Things like the formation of the skeleton is vital for all vertebrate creatures that will one day be born and live in space.

BACKGROUND

Fry, which is a juvenile fish, in space do not experience looping but otherwise grow normally. Looping is a behavior where fish swim in either vertical or horizontal circles instinctually.[Reebs, Stéphan G. "Fishes in Space." 2009] Some studies find a shrinkage of the egg in warmer waters. Since the ISS has a temperature of 75°F Shrinkage is very possible. This shrinkage of the membrane can lead to some malformation of the early fish development. With a shrunken membrane the embryo and yolk will have less room to exist in. Previous experiments that are similar show that fish adapt well to their new gravity but exhibit new behaviors. Some fish ignore behaviors previously done on earth because of disorientation.

The ways a fish embryo grows in microgravity can give insight on many things. It can help scientist see the early growth of not just animals in space but humans as well. The reason we want to know this is because when earth's organisms are grown in space in a lower gravity they may develop differently. If these defects are life threatening then they need to be fixed before an organism is even born. This is important to humans too if they plan to live in low gravity environments. This include things like bone degradation on early life. Humans may not be born from an egg but similar problems may appear in a mammal's birth. Since a mammal has a similar membrane in their development a similar shrinkage of that membrane may cause the same birth defects. Less space to develop in may cause deadly problems with things like the skeletal structure.

The experimental materials:

The American Shad's embryos were chosen because it takes about 12-15 days to be hatched at the temperature 52° F. The fish's eggs can be obtained at local fish hatchery.

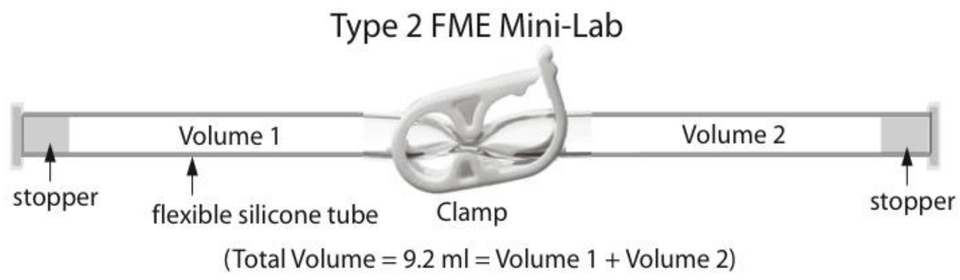
Experimental procedure:

Ground procedure:

Step 1- Place the 6.5 ml of water in volume 1.
Step-2 Tighten clamp directly over water sample.
Step 3-Use tweezers to place eggs in volume 2.
Step 4- Close off top end of the mini-lab

Experimental procedure: On ISS

Step1- When ready to start the experiment (A=0) release clamp to unite the water sample and eggs



ANALYSIS

The comparison between the two samples in space and on earth, as well as the experiment analysis will be provided after the mini-lab returned to us. The analysis will be included: Number or survival fish's embryos, size of the fish's, and the structure of the fish's body under microscope.

POTENTIAL OUTCOME

Survival fish/ death fish
Normal/ abnormal skeleton structure.

Figure 2: American Shad's Embryo

REFERENCES

1.) Lewis, Danny. "Fish Don't Do So Well in Space." *Smithsonian.com*, Smithsonian Institution, 16 Jan. 2017, www.smithsonianmag.com/smart-news/fish-dont-do-so-well-space-180961817/.

2.) (LSU), Louisiana State University. "Fish Shrinking as Ocean Temperatures Rise." *Louisiana State University*, www.lsu.edu/mediacenter/news/2017/10/04docs_turner_menhaden.php.

3.) http://www.cbf.org/about-the-bay/more-than-just-the-bay/chesapeake-wildlife/american-shad/index.html